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*North Carolina Geological Survey.* J. A. HOLMES, State Geologist, Bull. 13; Clay Deposits and Clay Industry in North Carolina, by HEINRICH REIS.

There are few things more noticeable and at the same time more gratifying in the recent work of the state geological surveys than the increased attention paid to the economic and industrial portion of the work. So long as it remains necessary to justify the existence of surveys to appropriation committees, it will remain pleasant to point to practical work and direct economic returns in neighboring states. It has been abundantly shown that legislators do not usually object to paying for a reasonable amount of purely scientific investigation, provided only that the practical work waiting to be done be not slighted. It is equally well demonstrated that it is only by conducting work along lines of both pure and applied science that state surveys attain their highest usefulness. They do better work and gain more quickly and hold more securely the confidence of those who pay for this work. Neglect of these truisms has led to the premature cutting off of more than one survey. It is pleasant, accordingly, to note that the reports coming from North Carolina are not only scientific in their accuracy, but practical in their scope. Such a paper as the one under review, by stimulating the development, and, in a sense, advertising the clay resources of the state, must inevitably be followed by direct material benefits. The care taken by the author to suggest changes and improvements in present treatment as well as to note lines of expansion, in view of his wide experience with clays, are exceedingly valuable.

The paper opens with a brief statement of the origin of clays, and a classification of those developed in North Carolina. This is followed by a clear, though condensed, discussion of the chemical and physical properties of clays and of the geography and geology of the North Carolina deposits. The kaolin or china clays, pottery clays, fire clays, pipe clays, and brick clays are then discussed briefly with reference to distribution, character and proper treatment. A large number of analyses and tests have been made, and are not only inserted, but are interpreted. To persons outside the state the chapter devoted to the kaolins will naturally attract the most attention, since it is kaolin from North Carolina which figures so largely in the pottery industry of the whole country. Judging from certain facts brought out in the report the time may come when the kaolin will be extensively used in its

home state. There will, however, be many matters to consider before the attempt is made. The present, being a preliminary report, leaves this as well as many interesting problems of cost, production, markets, and treatment almost untouched. We would like, for example, to know more about the fuel and labor costs, the type of dry houses and speed of drying found best adapted to the various clays, methods of burning, length of water-soaking, and many other things. These will, of course, be discussed in the final report, which will be eagerly anticipated by all interested in the clay industry.

Among the most valuable things in the present paper are the rational analyses and the large number of physical tests. The latter include the determination of the percentage of water necessary to give a workable paste, the approximate plasticity, the speed of slaking, texture, percentage of air and fire shrinkage, average and maximum tensile strength per square inch, the point of vitrification, vitrification and viscosity temperatures, total fluxes, color when burned, and specific gravity. There is nothing new or especially accurate with regard to the plasticity determinations, such general expressions as "lean," "fair," "good," etc., being used. It is not stated how many tests were used in getting the average tensile strength, nor is the range of variation given. In view of the method adopted, a minor variation from the standard cement test, the omission is important. For example, the pottery clay (No. 50) from Blackburn in Catawba county, gave an average tensile strength of 148 pounds, with a maximum of 200 pounds per square inch. Assuming that the minimum varied as much from the average as the maximum, and we have as the result a clay with tensile strength varying from 96 to 200 pounds, over 100 per cent. While some of the figures are closer, this is not exceptional except in the high strength. Other variations are 84 average to 120 maximum, 60 to 81, 14 to 16, 15 to 18, etc. In short, the results, judging from the imperfect data presented, show as wide or wider variation than is common in cements, and there is the same need here for an improved and more accurate test that cement users recognize. It would be interesting to know more also as to the methods adopted in making some of the tests. For example, does the percentage of water necessary to give a workable paste have reference to clays dried to a uniform state or taken from the bank? The difference might be considerable. Was the shrinkage measured in bulk on market products or along single directions on tests bricklets? Without this data the

results are somewhat less valuable for general comparison, though still of great importance. As a whole the report is to be highly commended. It is concise and fresh. It tells not only about North Carolina clays, but incidentally it gives the point of view of the modern student of clays. While no new methods are developed, there are no modern methods of value which have been overlooked. In addition to its other excellent features the paper is well printed and sufficiently illustrated.

H. F. BAIN.

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*Lehrbuch der praktischen Geologie. Arbeits- und Untersuchungsmethoden auf dem Gebiete der Geologie, Mineralogie, und Paläontologie.* Von DR. KONRAD KEILHACK, Kgl. preuss. Landesgeologen in Berlin. 639 pp. Stuttgart, 1896.

The title of this book fairly indicates its scope. It is essentially an exposition of the results to be sought in the field, and in the laboratory study of the materials gathered in the field, and of the methods by which these results are attained. It is the only book with which we are familiar which essays to deal with so comprehensive a subject. Geikie's *Outlines of Field Geology* covers in a briefer way some part of the ground of the present volume. Richtofen's *Führer für Forschungsreisende* gives many suggestions along the same lines. Nevertheless the present volume is so much more comprehensive than anything else which has been written on the subject that it may fairly be said to be without a rival.

Formidable as was the task which the author set for himself in the preparation of this work, it must be said to have been well done. Probably no two geologists would give instructions for the same work in the same way, and no one could be expected to make a treatise on so broad a subject equally satisfactory in all its parts; yet with all the exceptions which might be taken to the order or method of treatment, and with all the shortcomings which specialists in this department or that might point out (and they are neither numerous nor serious), the book might be read with profit by every geologist in the early stages of his work, and many parts of it by men who are no longer novices. The volume is naturally more satisfactory in those departments of geology where study has been longest prosecuted, and where methods and principles have become most firmly established; for example, the